Topology

★ Network Topology:-

→ A network topology is the physical and logical arrangement of nodes and connections in a network.

→ Nodes usually include devices such as switches, routers and software with switch and router features.

→ Network topologies are often represented as a graph.

→ Network geometry can be defined as physical topology and the logical topology.

→ Network topology types differ depending on how the network needs to be arranged.

★ Need for network topology:-

→ Network topology plays major role in how network functions.

→ Namely, the topology has a direct effect on network functionality.

→ Choosing the right topology can help increase performance, as a properly chosen and maintained network topology increases energy efficiency i.e data transfer rates.

→ A well defined network topology makes it easier for network admins to locate faults, troubleshoot issues and to allocate network resources.

→ Diagrams are an important reference point as they represent physical and logical layouts.

★ Types of Network Topology:-

→ The types of network topologies are:-

1. Bus Topology
2. Star Topology
3. Ring Topology
4. Mesh Topology
5. Tree Topology
6. Hybrid Topology

* Bus Topology:-

→ It is a network topology in which nodes are directly connected to common half duplex link called a Bus.

→ A host on a bus network is called a station. It receives all the traffic, and the traffic generated by each station has equal transmi-ssion priority.

→ A bus network forms a single network segment and collision domain.

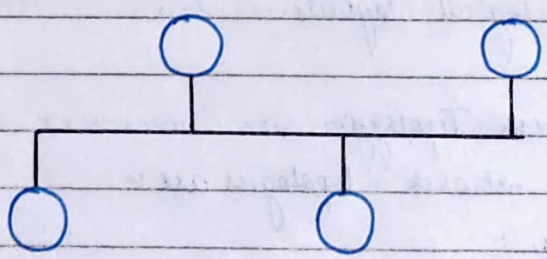
→ In order of nodes to share the bus, they use a medium access control technology such as carrier sense multiple access (CSMA) or a bus master.

→ Advantages:-

① Very easy to connect a computer or peripheral to a linear bus.
② The linear architecture is very simple and reliable.
③ It works well for small networks.
④ It is easy to extend by joining cable with connector or repeater.
⑤ Use of single cable, lower costs.

→ Disadvantages:-

① Collisions occur in the network resembling in packet loss.
② Bandwidth is shared among nodes; performance may degrade with many nodes on the network.



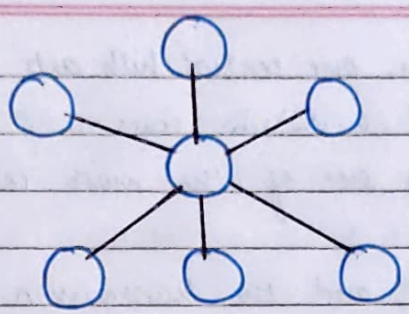
* Star Topology:-

→ A star network is an implementation of a spoke-hub distribution paradigm in computer networks.

→ In a star network, every host is connected to central hub.

→ In its simplest form, one central hub acts as a conduct to transmit messages.
→ The star network is one of the most common computer network topologies.
→ The hub and hosts, and the transmission lines between them, form a graph with topology of a star.
→ Data on a star network passes through the hub before continuing to its destination.
→ The hub manages and controls all functions of the network. It also acts as a ~~request~~ repeater for data flow.
→ The star topology reduces the impact of transmission line failure by independently connecting each host to the hub. Each host may thus communicate with all others by transmitting to and receiving from the hub. The failure of a transmission line linking any host to the hub will results in the isolation of that host from all others, but the rest of the network will be unaffected.
→ The star configuration is commonly used with twisted pair cable and optical fibre cable. However, ~~if~~ it can also be used with coaxial cable as in, for example, a video router.
→ Advantages:-
① If one node or its connection breaks, it does not affect the other computers nor their connections.
② Devices can be added or removed without disturbing the network, works well under heavy load appropriate for large network.

→ Disadvantages:-
① ~~Cables~~ Expensive due to number and length of cables needed to wire each host to central hub.
② The central hub is a single point of failure for the network.



★ Ring Topology:-

→ A network topology in which each node connects exactly to two other nodes, forming a single continuous pathway for signals through each node - a ring data travels from node to node, with each node along the way handling every packet.

→ Rings can be unidirectional, with all traffic travelling either clockwise or anticlockwise around the ring, or bidirectional (as in SONET/SDH).

→ Because a unidirectional ring networks may be disrupted by the failure of a single link.

→ A node failure or cable break might isolate every node attached to the ring.

→ In response, some ring networks add a "counter rotating ring" (C-ring) to form a redundant topology.

→ In event of a break, data are wrapped back onto the complementary ring before reaching the end of the cable, maintaining a path to every node resulting in C-ring.

→ Advantages:-

① Very orderly network where every device has access to the token and opportunity to transmit performs better than a bus topology under heavy network load does not require a central node to manage the connectivity between the computers.

② Due to point to point line configuration of devices with a device on either side (each device is connected to its immediate neighbour), it is quite easy to install and reconfigure since adding or removing a device requires moving just two connections.

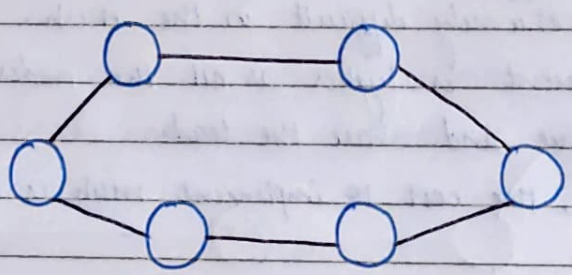
→ Disadvantages:-

① One malfunctioning workstation can create problems for the entire network. This can be solved by using dual ring or a switch that closes off the break.

② Moving, adding and changing the devices can affect the network.

③ Communication delay is directly proportional to number of nodes in the network.

④ Bandwidth is shared on all links between devices.



* Mesh Topology:-

→ A mesh network (or simply meshnet) is local area network topology in which the infrastructure nodes (i.e. bridges, switches and other infrastructure devices) connect directly, dynamically and non-hierarchically to as many other nodes as possible and co-operate with one another to efficiently route data to and from clients.

→ This lacks of dependency on one node allows for every node to participate in the relay of information.

→ Mesh networks dynamically self organize and self configure, which can reduce installation overhead.

→ The ability to self configure enables dynamically distribution of workloads, particularly in the event of a few nodes should fail.

→ This in turn contributes to fault tolerance and reduced maintainance costs.

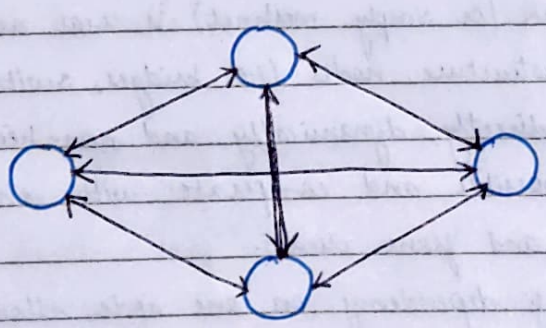
→ Advantages:-

① This topology provides multiple paths to succeed in the destination and tons of redundancy.

② It provides high privacy and security.
③ Data transmission is more consistent because failure doesn't disrupt its process.
④ Adding new devices wont disrupt data transmissions.

→ Disadvantages:-
① Its costly as compared to the opposite network topologies i.e. star, bus, point to point topology.
② Installation is extremely difficult in the mesh.
③ Power requirement is higher as all the nodes will need to remain active all the time and share the load.
④ Complex process, the cost to implement mesh is above other selections.

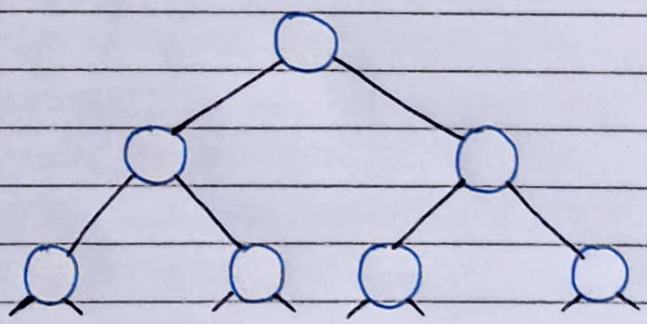
→ A fully connected mesh network is where each node is connected to every other node in network.



★ Tree Topology:-
→ This topology is the variation of the star topology.
→ This topology has a hierarchial flow of data.
→ In tree topology, SAC (Standard Automatic Configuration) protocols like DHCP and SAC are used.
→ The various secondary hubs are connected to central hub which contains the repeater.
→ This data flows from top to bottom i.e. from the central hub to secondary hub and then to ~~central~~ devices Or ~~Et~~ from bottom to top i.e. devices

to secondary and then to central hub.
→ It is a multi-point connection and non robust topology because if the backbone fails, the topology crashes
→ Advantages:-
① It allows more devices to be attached to single central hub thus it decreases the distance that is travelled by the signal to come to the devices.
② It allows the network to get isolated and also prioritize from different computers.
③ We can add new device to existing network.
④ The error detection and error correction is very easy in tree topology.

→ Disadvantages:-
① If central hub get fails the entire system fails.
② The cost is high because of cabling.
③ If new devices are added, it becomes difficult to configure.



* Hybrid Topology:-
→ This topology technology is the combination of all the various types of topologies we have studied above.
→ It is used when the nodes are free to take any form.
→ It means these can be individuals such as ring or star topology or can be combination of various types of topologies seen above.
→ Each individual topology uses protocol that has been discussed earlier.

→ Advantages:-

① This is very flexible, the sized of network can be easily expanded by adding new devices.

→ Disadvantages:-

① It is very difficult to design the architecture of the hybrid network.
② Hubs used in this topology are very expensive.
③ The infrastructure cost is very high as hybrid network requires alot of cabling, network devices.